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(54) EDGE PROTECTION OF VITREOUS PANELS

(71) We, GLAVERBEL - MECANIVER, a Belgian Body Corporate of 166 Chaussée de La Hulpe, Watermael- Boitsfort, Belgium, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of protecting an edge of a panel comprising at least one sheet of vitreous material which provides at least part of that panel edge, such method involving providing the panel with a protector of channel form covering that edge and continuous marginal zones of opposed faces of the panel. The invention also relates to panels provided with edge protection by that method.

The term "vitreous material" as used herein includes not only glass but also vitrocrystalline material, i.e., material formed from glass by subjecting it to a thermal treatment resulting in the appearance of one or more crystalline phases therein.

It is well known that sheets of vitreous material are very vulnerable at their edges. The edges of the sheets are liable to suffer damage during handling and transportation as a result of impact against hard objects. During transportation, vitreous sheets are normally supported edgewise and the edges sometimes become chipped or otherwise impaired at that time.

It has been proposed to protect the edges of sheets of vitreous material by fitting protective channel-section guards, usually made of wood or metal, over such edges. Experience shows that even when such guards are fitted, a substantial number of breakages occurs due to stresses propagated from the sheet edges. This is apparently due in most cases to the presence of defects such as scratches or notches which are present in the sheet edges before the guards are fitted. Such defects are liable to be produced for example during cutting of the sheets from continuous ribbons or larger blanks, and they act as stress raisers. The guards do not to any material extent reduce the vulnerability of the sheets to impact forces of quite small magnitude acting against the guards at the sites of such defects. Moreover such guards can easily be inadvertently displaced or pushed off the sheets during handling of them unless the guards exert a very strong grip on the margins of the sheets. The exertion of high pressures by the opposed side walls of the guards can however itself have adverse consequences. This is because unless the opposed faces of the vitreous sheets are truly flat and parallel over the whole extent of the marginal zones, the pressure exerted by the guards will not be uniformly distributed but will tend to be concentrated at certain positions. If a highly localised pressure occurs in the vicinity of a stress raiser, breakage of the sheet may occur. The localised pressure may itself spoil the surfaces of the vitreous sheets, particularly if metal guards are used.

The fitting of edge guards is moreover not at all a suitable method of protection in the case of vitreous sheets which are curved, as for example are the glass sheets which form or which form part of certain vehicle windscreens.

The need for edge protection also occurs

in respect of articles comprising an assembly of two or more vitreous sheets in face to face relationship. Example of such articles are laminated glass panels and panels incorporating two or more vitreous sheets held in spaced relationship. Prefabricated guards as above described can be fitted over the edges of such units so as to enclose the edges of the vitreous sheets but the disadvantages attendant on the use of such guards as above referred to are then even more in evidence because there is often likely to be a lack of true parallellism between the faces gripped by the guards.

It is possible to leave the prefabricated guards in place when the vitreous sheets are mounted in a frame, e.g., a window frame, but they are then liable to be a source of trouble, not least because they become water traps holding accumulations of water. This is most undesirable in particular for double glazing units, because of the risk of water penetrating the inter-sheet joints and entering the interiors of the units.

The present invention aims to provide an edge protecting method which is applicable to flat and curved sheets and enables vitreous sheets to be protected at least to some extent against the weakening effect of stress raisers at the edge zones of the sheets.

According to the present invention there is provided a method of protecting an edge of a panel comprising at least one sheet of vitreous material which provides at least part of that panel edge, such method involving providing the panel with a protector of channel form covering that edge and contiguous marginal zones of opposed faces of the panel, characterised in that said protector is formed in situ from a fluid coating material which sets or can be caused to set to form a solid body which undergoes shrinkage before setting is complete, such coating material being applied so as to cover such panel edge and contiguous marginal zones of the opposed faces of the panel and then being allowed or caused to set in situ to form the said protector in the form of a channel the opposed walls of which press elastically against said marginal zones under elastic forces stored in said channel due to said shrinkage.

This method has a number of important advantages as compared with the use of prefabricated guards. By virtue of the formation of the protector in situ by applying a fluid coating material the material which sets to form the protector is in intimate contact with the covered edge or edges of the vitreous sheet or sheets and with contiguous marginal zones of the opposed faces of the panel, regardless of the contour of such edges and face zones, and the pressures exerted on the opposed faces of the panel at the protected margin thereof are always substantially uniformly distributed along such margin. The applied fluid material can enter notches or cracks in or adjacent the edges of the vitreous sheet or sheets and in consequence the protector can reduce the risk of breakage occurring due to stresses propagated from the sites of such defects.

The method according to the invention is applicable regardless of the longitudinal profile of the panel edge to be protected, regardless of the cross-sectional profile of such edge, and regardless of whether the panel is flat or curved. The invention moreover enables effective edge-protection of panels comprising sheets of figured glass, which is not possible by means of prefabricated guards as hereinbefore referred to.

Another very important advantage of the method according to the invention is that it enables very good protection to be given to the edges of a panel at a corner zone where those edges meet. When prefabricated guards are employed a guard can be fitted over each of the margins of a rectangular panel but the protection thus afforded often does not extend or does not adequately extend to the corners of the panel. When applying the invention, the fluid material may be applied so as to cover contiguous edges and their meeting corner, without interruption, so that the material sets to form an integral protector covering the edges and the corner. In fact the fluid plastics can be applied so as to form a continuous protector enveloping the entire peripheral margin of a panel of rectangular or other shape. The protector can if desired be removed from the panel when it is mounted in a frame or is otherwise put to use.

The method can be applied for edge-protecting a panel consisting of a single vitreous sheet; for protecting the edges of panels comprising two or more sheets (at least one of which is a vitreous sheet), assembled in face to face contact; and for protecting the edges of hollow panels comprising two or more sheets (at least one of which is a vitreous sheet), held in spaced relationship.

When applying the method for protecting the edges of panels comprising two or more sheets assembled in face to face contact as above referred to, the contraction of the protector during setting thereof may be relied upon for holding the sheets together; but of course the method is also applicable in the case that the sheets are held together in part by other means, e.g., in the case that the sheets are bonded together to form a laminate.

The fluid coating material is preferably a plastics or plastics-containing material.

Preferably the coating material applied to the panel comprises a plastics material in molten state. Molten plastics are relatively easy to handle and to apply so as to build up

a deposit of adequate thickness for the purpose in view. Moreover contraction forces of appreciable magnitude can occur during cooling of the plastics from the molten state to room temperature. The nature of the applied composition and the temperatures at which coating is performed are preferably such that the applied coating solidifies as rapidly as possible. Advantageously the temperature of the edge zones of the panel onto which the coating material is applied is lower than the temperature of such molten plastics. They may for example be at room temperature. In that case the cooling of the coating material to form the required edge protector with elastic forces stored therein can be easily and quickly brought about.

According to a preferred embodiment of the method according to the invention, the coating material comprises a molten plastics material as aforesaid and is applied by spraying. This method of application enables the coating material to be applied quickly and with good control of the distribution of the material on the panel margin so as to form a protector of any required cross-sectional thickness and profile. The spraying method can moreover readily be performed in automated or semi-automated production lines by conveying a succession of panels past a spraying station or stations or by displacing a spraying head or heads along a line of panels.

Particular importance is attached to processes according to the invention wherein the coating material applied to the panel comprises a plastics material and is flame-sprayed onto the panel. This technique is conducive to the performance of the method in a highly efficient and economical manner and promotes the formation of a protector the plastics material of which penetrates into notches or other surface defects in the coated surface portions. In the flame spraying technique, the plastics coating material is continuously fed through the nozzle of a flame-sprayer so that the plastics is brought to an atomised condition in the flame and is heated in the flame and is discharged from the gun the atomised form. The plastics may be fed to the sprayer from an extruder. The plastics may for example enter the sprayer in molten condition or in solid form, e.g., in the form of a solid rod or thread which is progressively melted in the flame. The flame sprayer does not need to be frequently cleaned as does a sprayer used for spraying solutions of plastics material.

The use of a flame-sprayer is additionally of value in enabling the thickness of the plastics coating to be controlled and if required varied from one region of the panel margin to another. By way of example the thickness or gauge of the protector formed along a given margin can increase from the end regions towards the central region along such margin.

In certain embodiments of the invention, the coating material comprises polyvinyl chloride, a polyester, polyvinyl acetate, nylon or polytetrafluoroethylene. These materials have very useful combinations of properties for the purpose in view.

In other methods according to the invention, the coating material comprises a copolymer of ethylene and vinyl acetate and/or a copolymer of ethylene and acrylic acid. These plastics have been found to be particularly suitable for forming edge protectors which are highly effective.

As an alternative to forming the protector from a molten plastics, the protector may be formed by applying a composition containing one or more polymers in dispersed or dissolved state, e.g., by spraying, brushing, or dipping.

In general, advantages are to be gained from using a coating composition which during setting undergoes chemical and/or phase modification, e.g., crystallisation. An important example is the use of a coating composition comprising monomers which polymerise in situ. Generally speaking such modifications lead to an improved contact between the protector and the covered panel margin.

The coating composition may include various types of additives, e.g., pigments for colouring purposes, fillers such as wood, glass fibres, cement or metal powder, or components for accelerating or promoting solidification or hardening such as cross-linking components for cross-linking polymer chains.

Advantageously a substance which promotes adhesion of the coating to the panel margin is applied between the panel margin and the applied composition. Such substance may for example comprise a compound possessing groups which are reactive in respect of the material or materials of the coated surfaces and of the main constituent or constituents of the coating. In the case that the coated surfaces are glass surfaces, use is preferably made of silane compounds for that purpose. The improved adherence of the protector is useful not only for rendering the protector more resistant to displacement but also to provide a better seal against the ingress of fluid, e.g., water or steam, between the protector and the covered margin of the panel.

As already stated, the method according to the invention can be applied for protecting the edges of hollow panels. Thus the invention may be applied for protecting the edges of panels comprising two sheets jointed together at the region of the peripheral margin of the panel, said sheets being in spaced relationship over the whole area of the panel or over the whole area of the panel except at said marginal region. In such an

application of the method the coating material is preferably applied so that the channel protector formed by setting of such applied material covers the entire periphery of the panel, the opposed walls of the channel pressing elastically against marginal zones of the outer faces of said sheets. When performed in that way the method affords the most effective protection to the panel edge. However very useful protection can be afforded by forming two or more protectors in situ in accordance with the invention so that the protectors together cover the entire or the greater part of the periphery of the panel.

The protector or protectors formed on a hollow panel as above referred to may be relied upon for holding the sheets against an intervening spacer member or members, or additional securing means may be used, e.g., an adhesive for securing the sheets to such spacer member or members. The forces exerted on the opposed sheets by the protector or protectors due to the shrinkage thereof is sometimes higher if the sheets are held pressed towards each other by some extraneous means during the setting of the protector(s), the applied pressure being released when such setting is complete. The said protector or protectors may furthermore serve to hold the sheets in the required spaced relationship. In order to achieve this result, the fluid material from which the protector or protectors is or are formed is applied so as to extend between the facing surfaces of the sheets at their marginal zones, as well as over the marginal zones of the exterior faces of the panel. It is in any event preferable for the fluid plastics material to be applied so as to cover the inner faces of the sheets at their marginal zones so that the protector when set can reduce the risk of breakage occurring as a result of the presence of stress raisers in such inner face zones.

When manufacturing a hollow panel comprising two or more sheets spaced apart by an intervening spacer member or members, the sheets may be glued to such spacer member or members but if desired the pressures exerted on the outer faces of the panel at the marginal zones due to the shrinkage of the plastics may be relied upon for holding the sheets against the spacer(s).

By forming a protector in situ in accordance with the invention so that it envelopes the entire margin of a hollow panel, the protector assists or can be made solely responsible for sealing the interior of the panel.

It is not to be inferred from the foregoing that when the invention is applied for edge-protecting a vitreous sheet or sheets incorporated in a hollow panel, the invention necessarily involves the formation of a protector which covers edges of both sheets or of at least two of the sheets if there are more than two. On the contrary, the or each vitreous sheet of the panel can be provided with its own edge protector or protectors. In that case the or each protected sheet itself constitutes a panel within the meaning of that term as used in the definition of the invention hereinbefore set out and in the appended claims.

Reference has been made to the flame-spraying of a plastics material, and in particular of a plastics material which comprises a copolymer of ethylene and vinyl acetate and/or a copolymer of ethylene and acrylic acid. It is perhaps surprising that such plastics can be flame-sprayed. The temperatures in the flame of a flame-spraying gun are very high and may for example reach 1500°C or a higher temperature. It was to be expected that the plastics would burn or be destroyed in the flame, but this is not the case. It is particularly suitable to employ a plastics material of the kind marketed under the name "Hotmelt" by Plastic Union of Brussels, such material comprising an ethylene/vinyl-acetate copolymer or an ethylene/acrylic acid copolymer, together with paraffin wax and phenolic resin.

Preferably the flame spraying is achieved by continuously feeding the plastics from an orifice into a stream of combustible gas and oxygen within the nozzle of a flame-sprayer and simultaneously forcing a stream of air through that nozzle to give the required discharge velocity to the atomised plastics. A suitable sprayer is the flame-spraying gun which is marketed under the name MOGUL by Metallising Company of Europa GmbH, of 565 Solingen, Postfach 701, German Federal Republic. Preferably the oxygen and the combustible gas, e.g., natural gas or propane or a mixture of combustible gases are fed to the nozzle of the flame-sprayer under a pressure of 0.2 to 2.5 kgs/cm², the air being fed at a pressure of 2 to 7 kgs/cm².

In certain methods according to the invention, the flame-sprayed plastics is fed in molten condition to the nozzle of a flame-sprayer. By feeding the plastics in molten condition, the required atomisation of the plastics in the flame is facilitated.

Advantageously, the plastics is supplied to a said nozzle from a plastics melting and extruding or discharging apparatus. The use of a melting and extruding or discharging apparatus in combination with a flame-spraying gun is of particular value in enabling coating operations to be quickly performed in the course of mass-production or mass-processing. Preferably the plastics feeding through the nozzle of the flame-spraying gun has a temperature in the range 150 to 200°C and is under a pressure in the range 2 to 7 kgs/cm². These conditions have been found to give very good results using commercially

available equipment. A suitable melting and extrusion apparatus is that which is marketed under the name "Nordson V." (Trade Mark) by Nordson Corporation of Ohio, United States of America.

The invention also includes panels provided with edge protection by a method as hereinbefore defined. According to the present invention, a panel comprising at least one sheet of vitreous material which provides at least part of at least one edge of the panel and comprising at least one protector of channel forming covering the or said edge and contiguous marginal zones of opposed faces of the panel, is characterised in that said protector has been formed in situ by application and setting of a fluid coating material and has undergone shrinkage during such setting in consequence of which shrinkage the opposed walls of the channel press elastically against said marginal zones under elastic forces stored in the protector.

A panel having an edge protector or protectors according to the invention has the advantage that the pressures exerted on the opposed faces of the panel at the protected margin or margins thereof are always substantially uniformly distributed along such margin or margins. The material of the protector or protectors intimately contacts the surface portions of the sheet lying within the protector or protectors, even if such surface portions contain defects such as notches or chips. The protector or protectors thus serve to reduce the risk of breaking stresses being propagated from such stress raisers as hereinbefore referred to. In the case of a transparent protector, the presence of stored elastic forces in the protector can be detected by photoelasticimetry. If the protector can be removed from the panel the presence of such stored elastic forces will be revealed by mutual approach of the sides of the channel as it assumes a state of equilibrium.

Preferably the panel comprises at least one said protector which covers contiguous margins of the panel and a corner at which such margins meet. In that case corner protection is achieved which is superior to any corner protection which can be achieved by fitting prefabricated protectors onto contiguous panel margins so that the said protectors abut one against another.

Advantageously, the panel comprises a single said protector which envelopes the entire peripheral margin of the panel. The protection afforded is in that case optimum. The panel is very well suited for mounting in a frame or otherwise with the protector in place thereon.

In certain panels according to the invention, the panel comprises sheets which are held directly together or against an intervening spacer member or members by a said single protector enveloping the entire peripheral margin of the panel. Such a panel can be produced very quickly and at low cost.

The invention includes panels with an edge protector or protectors as aforesaid wherein such protector or protectors is or are formed wholly or mainly of polyvinyl chloride, a polyester, polyvinyl acetate, nylon or polytetrafluoroethylene.

The invention also includes panels with an edge protector or protectors as aforesaid wherein such protector or protectors is or are formed wholly or mainly of a copolymer of ethylene and vinyl acetate and/or a copolymer of ethylene and acrylic acid.

In the case of a panel according to the invention as hereinbefore defined, wherein the panel comprises two sheets jointed together at the region of the peripheral margin of the panel, said sheets being in spaced relationship over the whole area of the panel or over the whole area of the panel except at said marginal region, it is preferable for the said protector to have been formed so that it covers the entire periphery of the panel, the opposed walls of the channel pressing elastically against marginal zones of the outer faces of said sheets.

Various embodiments of the invention selected by way of example will now be described with reference to the accompanying diagrammatic drawings in which:—

Fig. 1 is a transverse cross-section of a double-glazing unit in course of its production by a process according to the invention;

Fig. 2 is a transverse cross-section of an insulating panel in course of production by a process according to the invention;

Figs. 3—5 are cross-sectional views of portions of three other panels according to the inventions.

Fig. 6 is an elevation, partly in cross-section, of an apparatus according to the invention for flame-spraying plastics coating material onto a substrate.

Fig. 1 illustrates a process for the production of a hollow panel 1 comprising two sheets of glass 2, 3 each measuring 50 × 40 × 0.4 cm. A continuous strip 4 of neoprene, the cross-sectional dimensions of which are 1.5 × 1 cm is inserted between the margins of the two glass sheets along the whole periphery thereof. The drawing represents a stage in the formation of an edge protector 5 which when constructed will have a channel section and will envelope the whole peripheral margin of the panel. The protector is formed in situ by spraying partially polymerised polyvinyl acetate at a temperature of 50°C on to the panel margin, using a hot air spray gun 6. The panel margins were at room temperature (20°C). As shown by the drawings the protector-forming composition is first sprayed onto one side of the panel and one part of the edge face of the panel. The panel is coated in this way along the whole of its

periphery so as to form one-half of the final protective channel, and then the composition is sprayed in a similar way from the other side of the panel so as to complete the channel. The applied composition is heated to complete polymerization of the vinyl acetate. During the setting of the channel it undergoes shrinkage with the result that the side walls of the channel press elastically against the outer faces of the glass sheets 2 and 3 so that these sheets are clamped against the intervening spacing bead 4 under the elastic forces stored in the channel.

As the polymer composition is sprayed onto the panel, the composition enters any notches or scratches which may be present on the coated surface portions of the glass sheets. The protector channel, when complete, is in intimate contact with the panel at all positions within the channel, and the forces exerted on the panel components by the channel are substantially uniformly distributed over the whole periphery of the panel.

If desired, polymerization of the protective composition can be promoted by incorporating therein a polymerization catalyst.

The protective composition can be sprayed onto the margins of the panels so that the thickness of the channel protector is greater over the central regions of the four margins thereof than at the end regions of those margins.

Prior to the application of the polymer composition, forces may be asserted on the exposed outer faces of the glass sheets 2 and 3 so as to place the interposed spacer strip 4 under some compression, the forces being maintained during the application of the polymer composition and the setting thereof. In that case the clamping pressure exerted on the sheets 2 and 3 by the protector channel, in the completed article, is greater because those clamping forces are due not only to the shrinkage of the protector channel during its formation but also to the elastic recovery forces in the spacer strip 4 which are released when the pressures exerted on the exposed outer faces of the glass sheets 2 and 3 during the formation of the channel are released.

In a modification of the embodiment above described with reference to Fig. 1, the plastics composition is applied so as to form a protector channel along only one margin of the panel.

In a further embodiment, the plastics composition is applied so as to form a protector channel enveloping the peripheral margin of a single sheet of glass so that the sides of the channel press elastically against the marginal portions of the opposed faces of the sheet.

Fig. 2 shows a partly completed panel 7 positioned over a trough B containing a coating composition 9 which is used in the formation of a protector channel on the panel margin. The panel comprises two sheets 10 and 11 of vitrocrystalline material each measuring 30 × 30 × 0.4 cm. The sheets are secured by layers of adhesive 12 and 13 to wooden spacer members which extend between the sheets along the four margins of the panel. Two of such spacer members, designated 14 and 15, are apparent in the drawing. The interior of the panel is occupied by a polyurethane foam insulating plate 16. The adhesive used for securing the wooden spacer members to the glass sheets is a "Thiokol" (Trade Mark) resin adhesive.

The four margins of the panel thus formed are successively immersed in the coating composition 9 held in the trough 8. This coating composition is a partially polymerized polyester resin at a temperature of 70°C. The coatings are rapidly cooled by a stream of air at 40°C until the polyester resin is completely polymerized. By such procedures the margins of the panel are enveloped by a protective channel 17. The dipping and setting steps are thereafter repeated so as to build up a further layer 18 of the polymer on top of the channel 17.

During the setting of the polymer it undergoes shrinkage so that the protector channel exerts clamping forces against the covered margins of the sheets 10 and 11, whereby the adhesive layers 12 and 13 are subjected to permanent compressive forces. It will be seen that the body of the resin forming the protector channel extends between the vitrocrystalline sheets at their peripheries so that the edge portions 19 and 20 are completely enveloped. These edge portions are not subjected to any harmful forces and the protector channel efficiently protects the whole periphery of the panel against damage during handling and transportation. The surface profile 21 of the protector channel facilitates the flow of water off the panel.

Fig. 3 shows part of a hollow glazing unit comprising two sheets 22, 23 made of glass the marginal portions of which sheets are bent towards each other and secured together by an adhesive layer 24 applied between the sheet edges. An edge protector 27 of channel section and composed of a vinyl polymer containing 5% by weight of pigment, has been formed in situ on the peripheral margin of the panel and has been set in situ so that the opposed sheets 22 and 23 of the panel are subjected to clamping forces by the said protector. The layer of adhesive 24, which is a silicon-based adhesive reinforced with glass fibres had, prior to the formation of the protector channel, a thickness of 4 mm. In the course of the shrinkage of the protector channel the thickness of the adhesive joint was reduced, by the clamping forces, to 2 mm. By virtue of the reaction forces imposed by the assembled glass sheets on the flanges 25 and 26 of the

protector channel, the bridge portion 27 of this protector channel is under tension.

The unit shown in Fig. 4 comprises two sheets 28, 29 made of ordinary glass. The marginal portions of the sheets have been secured to an intervening spacer ribbon 30. Preparatory to the jointing of the said sheets, the marginal portions of their inner faces were metallised and provided with solder layers 31, 32. The sheets are held to the spacer ribbon 30 by solder beads 33 formed between the coated margins of the sheets and the said spacer ribbon. A coating composition comprising a polyester has been applied to the peripheral margin of the panel so as to form in situ a protector channel 34 the opposed walls of which press elastically against the margin of the panel under elastic forces stored in the said channel due to shrinkage thereof during the setting of the polyester. The cross-section of the protector channel is such that there are thickened zones 35 between the central bridge portion of the channel and its opposed walls which cover the marginal portions of the outer faces of the glass sheets. By virtue of such cross-sectional shaping the channel is able to exert forces of appreciable magnitude against such opposed face portions.

The panel represented in Fig. 5 comprises two sheets 36 and 37, the marginal portions of which are clamped against an interposed rubber spacer bead 38 by elastic forces stored in a protector channel 39 which has been formed in situ from a composition comprising polyvinyl chloride applied by means of a hot air spray gun. Prior to the application of this composition, the marginal portions of the outer faces of the glass sheets 36 and 37 were coated with thin layers 40 and 41 of gamma propyl dimethyl triethoxysilane to improve the adhesion of the applied plastics composition to the glass sheets. The spacer bead 38 is quite strongly compressed by the contractive forces in the protector channel and the hollow panel is efficiently hermetically sealed. Other embodiments of the invention (not illustrated) comprise panels as represented in Fig. 5 and produced as above described except that in one case nylon and in another case polytetrafluoroethylene instead of polyvinylchloride was used for making the protector.

In further embodiments of the invention (not illustrated) the procedures for forming protectors as above described are applied for forming protectors on curved panels. A curved panel of this type may comprise for example a wooden sheet and be a decorative panel.

Fig. 6 illustrates an installation for coating a substrate with a plastics material using a flame-spraying technique in accordance with the invention.

The installation comprises an extrusion head 42 to which plastics material can be continuously supplied via a conduit 43. The extruder is of a type designated Nordson V, marketed by Nordson Corporation of Ohio, United States of America. Plastics material is discharged from the head 42 along a discharge tube 44, into a flame sprayer 45 fixed to such tube. The flame sprayer comprises a body portion 46 with a central boss 47 onto which an inner nozzle component 48 is clamped by a clamping ring 49 which is screwed onto such boss. A conical shell 50 is screwed onto an outer annular flange 51 of the body portion of 46 and an outer nozzle component 52 is screwed into the lower end of such shell.

A conduit 53 is connected to the body portion 46 of the burner head and communicates with a passageway 54 which is formed in such body portion and which opens into a recess 55 formed in the bottom face of the central boss 47. The said recess is in communication with passageways 56 which extend through the inner nozzle component 48 to the free end of such component. A conduit 57 is connected to the body portion 46 of the burner head and communicates with a passageway 58 which is formed in such body portion and opens into its bottom face between the central boss 47 and the peripheral flange 51 so that such passageway is in communication with the space 59 at the interior of the shell 50.

When the flame sprayer is in use, a mixture of propane and oxygen is fed to the flame sprayer via conduit 53 so that such gas mixture is continuously discharged from the inner nozzle compartment 48 via the passageways 56 therein. At the same time air is fed to the flame sprayer via conduit 57. This air flows through the space 59 within the shell and through an annular space 60 defined between the inner and outer nozzle components and discharges into the discharging propane-oxygen mixture. The combustible gas mixture discharging from the nozzle is burned to form a very high temperature flame. The plastics material which is fed along the tube 44 discharges directly into the flame via a central bore 61 in the inner nozzle component and becomes divided in the flame into very small droplets which are projected from the flame sprayer as a fine high velocity spray.

The described flame sprayer is of a type designated MOGUL, marketed by the Metallising Company of Europa GmbH of 565 Solingen, W. Germany.

Very suitable operating conditions are as follows:—

Feed pressure of plastics to extrusion head 3.5 kg/cm².

Temperature of plastics feeding to extrusion head 175°C.

Gas pressure in conduit 53 1 kg/cm².

Air pressure in conduit 57 4 kg/cm².

Fig. 6 shows the flame-sprayer located

above conveyor 62 which is used for conveying a sheet such as 63 beneath the flame sprayer so that the flame-sprayed plastics forms a continuous coating 64 thereon as a step in forming a channel protector enveloping the edge faces of the sheet and the contiguous marginal portions of the opposed face of the sheet.

A very suitable plastics material for flame-spraying by means of the apparatus represented in Fig. 6 can be formed by adding to molten copoly (ethylene/acrylic acid) or copoly (ethylene/vinyl acetate):—

(a) paraffin wax or microcrystalline wax in order to lower the melting temperature of the plastics composition,

(b) phenolic resin or colophony to increase the tackiness of the composition and

(c) a filler such as clay, carbon black or quartz.

The following is an example of a plastics coating material which may be flame-sprayed according to the invention:—

	Parts by weight
Ethylene/vinyl acetate copolymer (Melt Index 20)	30
Ethylene/vinyl acetate copolymer (Melt Index 3)	12
Ethylene/vinyl acetate copolymer (Melt Index 220)	6
Microcrystalline wax (Melting Point 180°F)	20
Double-refined paraffin	7
Polyterpene resin	33
Dioctyl adipate (as plasticiser)	0.8
Anti-oxident	1
Aluminium (as filler)	15

Having regard to the provisions of Section 9 of the Patents Act, attention is directed to the claims of Patent No. 1,386,292.

WHAT WE CLAIM IS:—

1. A method of protecting an edge of a panel comprising at least one sheet of vitreous material which provides at least part of that panel edge, such method involving providing the panel with a protector of channel form covering that edge and contiguous marginal zones of opposed faces of the panel, characterised in that said protector is formed in situ from a fluid coating material which sets or can be caused to set to form a solid body which undergoes shrinkage before setting is complete, such coating material being applied so as to cover such panel edge and contiguous marginal zones of the opposed faces of the panel and then being allowed or caused to set in situ to form the said protector in the form of a channel the opposed walls of which press elastically against said marginal zones under elastic forces stored in said channel due to said shrinkage.

2. A method according to claim 1, characterised in that the said coating material applied to the panel comprises a plastics material in molten state.

3. A method according to claim 2, characterised in that the temperature of the edge zones of the panel onto which the coating material is applied is lower than the temperature of such molten plastics.

4. A method according to claim 2 or 3, characterised in that said coating material is applied by spraying.

5. A method according to claim 4, characterised in that the coating material is flame-sprayed onto the panel.

6. A method according to any of claims 2 to 4, characterised in that the coating material applied to the panel comprises polyvinyl chloride, a polyester, polyvinyl acetate, nylon or polytetrafluoroethylene.

7. A method according to any of claims 2 to 5, characterised in that the coating material applied to the panel comprises a copolymer of ethylene and vinyl actate and/or a copolymer of ethylene and acrylic acid.

8. A method according to any preceding claim characterised in that between the panel margin and the applied coating material a substance is applied which promotes adhesion of such coating material to said margin.

9. A method according to any preceding claim, wherein said panel comprises two sheets jointed together at the region of the peripheral margin of the panel, said sheets being in spaced relationship over the whole area of the panel or over the whole area of the panel except at said marginal region, characterised in that said coating material is applied so that the channel protector formed by setting of such applied material covers the entire periphery of the panel, the opposed walls of the channel pressing elastically against marginal zones of the outer faces of said sheets.

10. A method according to claim 5, characterised in that the plastics is flame-sprayed by continuously feeding the plastics from an orifice into a stream of combustible gas and oxygen within the nozzle of a flame-sprayer and simultaneously forcing a stream of air through that nozzle to give the required discharge velocity to atomised plastics.

11. A method according to claim 10, characterised in that the combustible gas and oxygen are fed to said nozzle under a pressure of from 0.2 to 2.5 kgs/cm^2 and the air is fed to said nozzle at a pressure of from 2 to 7 kgs/cm^2.

12. A method according to any of claims 5, 10 and 11, characterised in that the flame-sprayed plastics is fed in molten condition to the nozzle of a flame-sprayer.

13. A method according to claim 12, characterised in that the plastics is continuously fed to said nozzle from a plastics melting and extruding apparatus.

14. A method according to claim 12 or 13,

characterised in that the plastics feeding through the said nozzle has a temperature in the range 150 to 200°C and is under a pressure in the range 2 to 7 kgs/cm².

15. A panel comprising at least one sheet of vitreous material which provides at least part of at least one edge of the panel and comprising at least one protector of channel form covering the or a said edge and contiguous marginal zones of opposed faces of the panel, characterised in that said protector has been formed in situ by application and setting of a fluid coating material and has undergone shrinkage during such setting in consequence of which shrinkage the opposed walls of the channel press elastically against said marginal zones under elastic forces stored in the protector.

16. A panel according to claim 15, characterised in that there is at least one said protector which covers contiguous margins of the panel and a corner at which such margins meet.

17. A panel according to claim 15, characterised in that there is a single said protector which envelopes the entire peripheral margin of the panel.

18. A panel according to claim 17, characterised in that said panel comprises sheets which are held directly together or against an intervening spacer member or members by such protector.

19. A panel according to any of claims 15 to 18, characterised in that the said protector or protectors is or are formed wholly or mainly of polyvinyl chloride, a polyester, polyvinyl acetate, nylon or polytetrafluoroethylene.

20. A panel according to any of claims 15 to 18, characterised in that the said protector or protectors is or are formed wholly or mainly of a copolymer of ethylene and vinyl acetate and/or a copolymer of ethylene and acrylic acid.

21. A panel according to any of claims 15 to 20, such panel comprising two sheets jointed together at the region of the peripheral margin of the panel, said sheets being in spaced relationship over the whole area of the panel or over the whole area of the panel except at said marginal region, characterised in that said protector has been formed so that it covers the entire periphery of the panel, the opposed walls of the channel pressing elastically against marginal zones of the outer faces of said sheets.

22. A method of protecting an edge of a panel substantially as herein described with reference to the accompanying drawings.

23. A panel having at least one edge protector formed by a method substantially as herein described.

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1426906 COMPLETE SPECIFICATION
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

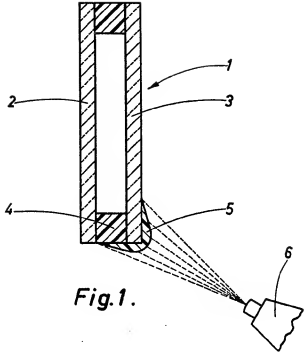

Fig.1.

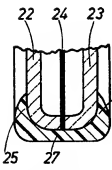

Fig.3.

Fig.4.

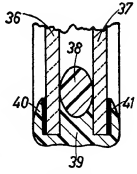

Fig.5.

1426906 COMPLETE SPECIFICATION
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

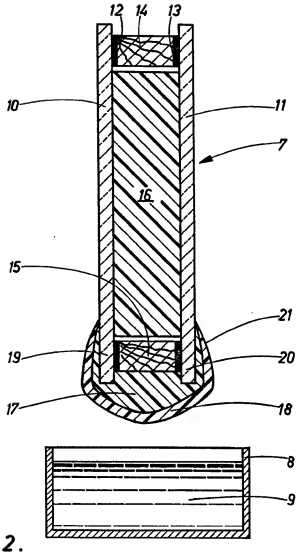

Fig. 2.

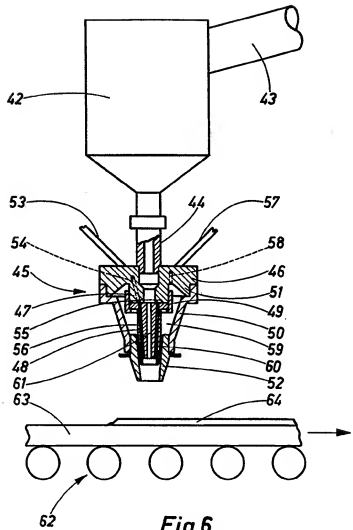

Fig.6.